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ABSTRACT

This paper presents the results of a survey that was administered to mathematics methods instructors, mathematics supervisors, inservice elementary school teachers, and preservice elementary teachers to investigate their beliefs about what should be taught in a preservice mathematics methods course. Current trends, doing mathematics, teaching a lesson, curriculum resources, manipulatives, problem-centered teaching, and questioning techniques received the highest mean responses from participants. (ASK)

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What Really Should be Taught in the Elementary Mathematics Methods Course?

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Introduction

As we all know, mathematics education in the United States is going through a dramatic change. The kind of teaching advocated is very much different from what was acceptable, say, 20 years ago. This observation led us to our initial question: What should be taught in a preservice elementary mathematics methods course? Is what was acceptable 20 years ago still appropriate in today=s mathematics methods course?

In addition, we all heard or read about some inservice teachers saying their college courses were useless. These individuals are the exception because there are many teachers who can claim that they have learned many valuable insights and ideas in their preservice teacher education programs. However, this perception indicates that, at least for some teachers, there is a mismatch between what preservice courses offer and what they need in their classrooms. This observation led us to modify our initial question and ask: What do different groups of people believe should be taught in preservice mathematics methods course?

Survey Instrument

To investigate these questions, we constructed a survey that was administered to mathematics methods instructors, mathematics supervisors, inservice elementary school teachers, and preservice elementary teachers. The survey was organized according to the NCTM=s *Professional Standards for Teaching Mathematics* (NCTM, 1991). The *Professional Standards* include six standards for professional development of mathematics teachers: (1) experiencing good mathematics teaching, (2) knowing mathematics and school mathematics, (3) knowing students as learners of mathematics, (4) knowing mathematical pedagogy, (5) developing as a teacher of mathematics, and (6) the teacher=s role in professional development. For the survey instrument, we combined the last two standards into one category. The category on mathematical pedagogy was further divided into five sub-categories: (1) resources, (2) teaching/organizational strategies, (3) discourse, (4) assessment, and (5) classroom management.

The 53-item, Likert-scale draft survey was posted on the AMTE discussion list in December, 1997. The participants were asked to respond on a 4-point scale where where 1 indicated that topic should not be included and 4 indicated that topic must be included. Based on the responses we received, we made several changes, and the final survey instrument contained 50 statements. In addition, seven background questions were included except for preservice teachers. The complete set of items is included in the Appendix. [Item 19, *Benchmarks*, refers to *Benchmarks for Science Literacy* (American Association for the Advancement of Science, 1993). However, the reference to AAAS was accidentally omitted. Based on some of the written responses we received, it was clear that this item was interpreted differently by different

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people. Therefore, the item was dropped from this analysis.]

Participants

There were four groups of participants in this study.

- M Elementary mathematics methods instructors
- S Mathematics >supervisors=
- I Inservice elementary school teachers
- P Preservice elementary school teachers
  - P1 at the beginning of their mathematics methods course
  - P2 at the end of their mathematics methods course
  - P3 at the end of their student teaching

97 names were selected at random from the AMTE membership list. In order to increase the likelihood of selecting those people who teach elementary mathematics methods course, only those with institutional addresses were considered. In general, those with the address in mathematics department were not included, unless it was known that the elementary methods course was taught from the mathematics department, for the same reason.

The survey was sent to 67 mathematics >supervisors= in the State of Maryland. Their names were obtained from the list of mathematics leaders prepared by the Maryland State Department of Education in 1998.

P1 and P2 were preservice teachers enrolled in elementary mathematics methods course at Towson University during the fall semester, 1998. P3 were elementary education majors who completed their student teaching in the spring semester, 1998.

Finally, three elementary schools with different degrees of involvement in preservice teacher education participated in this survey. One school was a Professional Development School (PDS). Another school was a PDS for one year but currently inactive as a PDS. This school was also a technology magnet school. The third school regularly hosts preservice teachers who are enrolled in mathematics methods practicum course at Towson University.

Results

We will share the results to nine specific questions that compared the responses of different participant groups.

Question 1: Is there a consensus among mathematics methods instructors on what should be taught in an elementary mathematics methods course?

To answer this question, we looked at the standard deviations. The standard deviation ranged from 0.842 to 1.407, and they were generally about 1. Although we did not conduct a statistical analysis, an informal comparison of these standard deviations indicated that they tend to be higher than those of other groups. Other groups often included some items with extremely low standard deviations.

Question 2: Is there any significant difference between M and S on what should be taught in an

elementary mathematics methods course?

The responses to nine items, statements 10, 12, 20, 41, 43, 44, 47, 49, and 53, were significantly different. It should be noted that the State of Maryland has implemented a state-mandated performance assessment program in 1993. Therefore, it was not surprising that the supervisors= mean response to item 49 was much higher than that of the methods instructors. In general, however, there seems to be a reasonable agreement between M and S.

Question 3: Is there any significant difference between M and T on what should be taught in an elementary mathematics methods course?

The mean responses to twelve items, statements 10, 22, 37, 41, 42, 43, 47, 49, 51, 52, 53, and 56, were significantly different. Some of these differences were not surprising, for example, statements 52 (report card) and 53 (discipline strategies). On the other hand, significant differences on items 42 and 42, unit and yearly planning, respectively, were unexpected. However, in general, there seems to be a reasonable agreement between M and T.

The next four questions concern the comparison of the methods instructors with preservice teachers at three different points in time. We want to remind the readers that P1 and P2 were the same group while P3 was a different group.

Question 4: Is there any significant difference between M and P1 on what should be taught in an elementary mathematics methods course?

Question 5: Is there any significant difference between M and P2 on what should be taught in an elementary mathematics methods course?

Question 6: Is there any significant difference between M and P3 on what should be taught in an elementary mathematics methods course?

Question 7: Will there be more consensus between preservice teachers and methods instructors as preservice teachers progress through their program?

At the beginning of the methods course, there were twenty items with significant differences. This number declined to twelve by the end of the semester, which is about the same level of agreement as with the mathematics supervisors and inservice teachers. At the end of student teaching (P3), there were 16 items with significant differences. Thus, although there seems to be a slight pattern of convergence in the mean responses from the beginning to the end of the methods course, there appears to be no general trend.

The next question does not specifically relate to our research focus, i.e., what should be taught in the methods course. However, we were curious to see how preservice teachers= views might have changed over the course of their undergraduate program.

Question 8: Is there any significant difference between P1 and P3 on what should be taught in an elementary mathematics methods course?

There were six items, statements 20, 23, 31, 47, 49, and 52, with significant difference. Thus, in general, preservice teachers= ideas of what should be taught in an elementary mathematics methods course seems to remain unchanged during their undergraduate program.

Discussion

So, what should be taught in an elementary mathematics methods course? The following seven items received the mean responses of 3.5 or above from the methods instructors, mathematics supervisors, and inservice teachers: 15 (current trends), 16 (doing mathematics), 28 (teaching a lesson), 29 (curriculum resources), 30 (manipulatives), 38 (problem centered teaching), and 44 (questioning technique). In addition, the methods instructors and the mathematics supervisors agreed that 18 (NCTM Standards), 31 (use of calculators) and 58 (critiquing of own teaching) are important components of the methods course.

The inservice teachers and the supervisors also seem to feel that 10 (demonstration lesson), 12 (lesson plan analysis/critique), 37 (writing in mathematics), 41 (lesson plans), 47 (authentic assessment) and 49 (performance assessment) are important topics. The methods instructors= mean responses to these items were only slightly below 3.5, except for the item 10 (mean = 2.583).

On the other hand, only a few items received the mean response below 2.5. Moreover, there was no agreement among M, S, and T groups on those items. Although items 13 (historical/cultural aspects of school mathematics), 21 (introduction to mathematics education research), 26 (interviewing children) and 55 (conference attendance) all received the mean score below 3.0 from all participant groups, in general, there seems to be little agreement on what topics can be omitted from an elementary mathematics methods course.

Closing Remarks

Although our analysis did not focus on the direction of differences among different participant groups, an informal observation of these results raise several important questions to those of us who teach elementary methods courses. We will conclude this paper by discussing some of the implications.

Six items, 10, 22, 40, 42, 43, and 53 received the mean response of less than 3.0 by the methods instructors but above 3.0 by the inservice teachers, the supervisors, and the preservice teachers after their student teaching. We believe that a part of the reason for a lower response for item 10 (demonstration lesson) is the difficulty to make such an arrangement. The contrasting responses to Item 53 (discipline strategies) were not surprising. However, Items 22 (learning styles), 42 (unit plan) and 43 (yearly plan) were unexpected. We do not believe that the mathematics methods instructors consider learning styles unimportant. In fact, the increased emphasis on spatial sense and alternative assessment strategies are just two examples of how individual children=s needs are being addressed. Perhaps the methods instructors need to consider how to make these connections clearer. Moreover, the methods instructors need to ask

themselves whether or not they are meeting the needs of the preservice teachers in the area of long-term planning. This is an essential idea in creating a cohesive mathematics curriculum. Perhaps the methods instructors need to place an increased emphasis on these items.

In contrast, three items, 23 (misconceptions), 24 (equity), and 33 (Internet), received the mean response of above 3.0 from the methods instructors but less than 3.0 from the inservice teachers and the supervisors. It is interesting to note that both teachers and supervisors thought students= learning styles are important but their misconceptions or the issue of equity are not as important. Of course, the opposite was true with the methods instructors. Perhaps we all need to reflect how these ideas may be related to each other.

References

American Association for the Advancement of Science (1993). *Benchmarks for science literacy*. New York: Oxford University Press.

National Council of Teachers of Mathematics (1991). *Professional standards for teaching mathematics*. Reston, Virginia: the Council.

Elementary Mathematics Methods Course Survey

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Part I: Background Information

1. How many years of teaching experience do you have in the elementary school?
   _____

2. Have you taught mathematics in the elementary school in the last 5 years?
   _____ Yes
   _____ No

3. Please check your appropriate title (you may check more than one if appropriate)
   _____ Classroom Teacher
   _____ Mathematics Supervisor
   _____ Principal
   _____ Mathematics Methods Instructor
   _____ Other (Please describe: _____
_)

4. If you are presently an elementary classroom teacher, what grade level do you teach? _____

5. Have you taught an elementary mathematics methods course in the last 5 years?
   _____ Yes
   _____ No

6. Do you have a membership in the National Council of Teachers of Mathematics (NCTM)
   _____ Yes
   _____ No

On a scale of 1 to 5, 5 being the highest and 1 being the lowest. How would you rank your level of familiarity with the following NCTM publications?

7. _____ Curriculum and Evaluation Standards for School Mathematics
8. _____ Professional Standards for Teaching Mathematics
9. _____ Assessment Standards for School Mathematics

Part II: Methods Topics/classroom activities

The list of topics/classroom activities are not exhaustive. Please comment if there are any additional topics/classroom activities you believe should be included in the course in the space provided. Choose the number that best describes the necessity of including each topic in a methods course using the following scale:

4 - topic **must** be included
3 - topic **should** be included
2 - topic important, but **could be omitted**
1 - topic **should not be included**
0 - I do not know

TOPICS/CLASSROOM ACTIVITIES

Experiencing Good Mathematics Teaching

10. _____ Demonstration lesson by the instructor in an elementary classroom

11. _____ Simulated lesson taught by the instructor in the college classroom

12. _____ Lesson plan analysis/critique

Knowledge of Mathematics & School Mathematics

13. _____ Historical/cultural aspects school mathematics

14. _____ Nature of mathematics

15. _____ Current trends in school mathematics

16. _____ Doing mathematics

17. _____ Curriculum analysis/critique

18. _____ NCTM Standards

19. _____ Benchmark

20. _____ Local issues (such as state assessment)

Knowing Students

21. _____ Introduction to mathematics education research

22. _____ Different learning styles

23. _____ Misconceptions about mathematics

24. _____ Equity issues in mathematics

25. _____ Constructivism

26. _____ Interviewing children

27. _____ Tutoring a child

28. _____ Teaching a lesson

Mathematical Pedagogy

Resources

29. _____ Knowledge of curriculum resources

30. _____ Use of various manipulatives in classrooms

31. _____ Use of calculators in classrooms

Use of computers in classrooms

32. _____ software

33. _____ Internet

34. _____ Use of audiovisual in classrooms

Teaching/Organizational Strategies

35. _____ Use of collaborative learning

36. _____ Use of direct instruction

37. _____ Use of writing in mathematics

38. _____ Use of problem centered teaching

39. _____ Conducting whole class discussion

40. _____ Learning centers

41. _____ Lesson plans

42. _____ Unit plans

43. _____ Yearly plans

Discourse

44. _____ Questioning techniques

45. _____ Knowledge of students= roles (cf. Professional Standards)

46. _____ Knowledge of teachers= roles (cf. Professional Standards)

Assessment

47. _____ Authentic assessment

Various alternative assessment strategies

48. _____ Interviews

49. _____ Performance assessment

50. _____ Observation

51. _____ Portfolios

52. _____ Preparing report cards

Management

53. _____ Discipline strategies

Professional Development

54. _____ Discussion of various professional organizations (such as NCTM, local NCTM affiliate, School Science and Mathematics, etc.)

55. _____ Conference attendance

56. _____ Reading of professional journals such as *Teaching Children Mathematics*

57. _____ Critiquing of a lesson by in-service teacher or by peers

58. _____ Critiquing of own teaching

59. _____ Developing professional development plan